REMARKS

In response to the Office Action mailed April 7, 2004, Applicant respectfully requests reconsideration. Claims 1-2, 5-8, 10-27, 30-33 and 35-66 have been previously examined. By this Amendment, claims 1, 7, 8, 10, 26, 35, 42, 43, 47 and 62 are amended. Accordingly, claims 1-2, 5-8, 10-27, 30-33 and 35-66 are pending in this application, of which claims 1, 10, 26, 35, 43, 47, 52 and 62 are independent claims. The application as presented is believed to be in allowable condition.

II. Rejections Under 35 U.S.C. § 103

The Office Action rejects all of the claims (including independent claims 1, 10, 26, 35, 43, 47, 52 and 62) under 35 U.S.C. § 103 as being unpatentable over by Shih et al. (U.S. Patent No. 6,421,048) in view of Xavier (U.S. Patent No. 6,407,748). Applicant respectfully traverses this rejection

While Applicant does not concede that the combination of Shih and Xavier is proper, and reserves the right to argue such a combination at a later date, even if the combination were proper, Applicant's claims distinguish over the combination. The rejections set forth in the Office Action rely on mischaracterizations of Shih and a number of concepts disclosed by Applicant and recited in the claims. In particular, the Office Action alleges that posture maps, guide zones, snap-fit regions and niceness factors are anticipated by various disclosure in Shih describing patently different subject matter.

Specifically, the Office Action asserts that 1) "Shih teaches (Fig. 4) a hepatic rendering process between a virtual tool and a virtual object as shown in Fig. 4, which includes a step of determining a geometry for the virtual surface (72). It would have been obvious that determination of geometry for the virtual surface (72) is functionally equivalent to the desired 'generation of a posture map' and 'guide zones.'" (Page 4 of the Office Action), and 2) "Shih teach that the vector and density computation are used to project any point within the virtual object (26) to the virtual surface (25) of the virtual object (26) in order that the potential surface contact point (226) is calculated ... It would have been obvious that density evaluations and contact point

determinations equivalently provide the desired 'niceness factors' and 'snap-fit regions.'" Applicant respectfully disagrees.

With respect to 1) above, Applicant does not understand how the "determination of geometry for the virtual surface" can be functionally equivalent to *both* posture maps and guide zones, when posture maps and guide zones describe two different constructs. The rejection is inconsistent on its face. Furthermore, the alleged teaching of Shih fails to anticipate either posture maps or guide zones. Rather, the alleged teaching in Shih (step 72 of FIG. 4) describes only a geometrical analysis of a virtual surface at a point of penetration of a virtual tool. Column 10, lines 43-50 in Shih describe step 72 as follows:

> If at least one of the points of the virtual tool 28 has penetrated the virtual object 26, then the haptic rendering process 16 determines a geometry for the virtual surface at the area of penetration of the virtual tool 28 (step 72). For example, the haptic rendering process 16 determines if the virtual object 26 has an edge, trough, valley, vertex, or hole in the vicinity of the virtual tool 28.

Shih is merely describing the process of determining the geometry of the virtual surface at a point of intersection of the virtual tool so that the correct force *resulting from the penetration* may be applied to the haptic interface. That is, Shih describes a process of determining geometrical characteristics of the surface itself (e.g., whether the virtual surface forms an edge, trough, etc.) in a region local to a point of penetration between two colliding virtual objects. In contrast, both posture maps and guide zones refer to respectively different constructs that are separate from and external to the representation of the virtual objects involved in the collision, and provide forces that are independent of the penetration forces.

A. Tool Postures and Posture Maps

A posture map is a construct, distinct from the representation of the virtual objects in a simulation, that stores a set of postures at different locations in space that define one or more desirable tool paths. Applicant respectfully directs the Examiner's attention to page 6, line 20 *et. seq.* of Applicant's specification, which describes a tool posture as "the x-y-z position of tool 10 and its orientation relative to the x-y plane." The tool posture is not the description of the geometry of the tool (or the body) as the Office Action alleges, but rather the description of its

location and orientation in space (i.e., it describes the tool's pose). Moreover, a posture map is a collection of such poses. As discussed further on page 17, line 17 *et. seq.*, a posture map is formed from a plurality of tool postures that meet a certain criteria. The resulting posture map from a given simulation can be used as a desired tool path for subsequent simulations. There is no similarity much less an equivalency between the "geometry for the virtual surface" and a posture map. The posture map construct is distinct and separate from the geometrical representation of the object itself, and is entirely missing from Shih. Determining a posture map and determining a geometry for a virtual surface are simply two different things, both in form and functionality.

B. Guide Zones

The Office Action asserts that "determining a geometry of the virtual surface" is also functionally equivalent to the concept of a guide zone. As with a posture map, a guide zone is a construct that is independent of the virtual objects in a collision (e.g., the virtual tool and virtual surface in Shih) and independent of the representations of such virtual objects. A guide zone operates to provide a force feedback when the virtual objects are not in contact with each other. In particular, a guide zone defines separate and distinct influences on a virtual tool that are independent of the contact between the virtual tool and a virtual surface. One example of a guide zone is the "snap guide" or "snap-fit" region described, amongst other places, on page 18, line 13 *et seq.* of Applicant's specification.

In contrast, the Shih disclosure only describes interactions and forces *generated by the collision and penetration of a virtual tool and a virtual surface*. If there is no contact between the virtual tool and the virtual surface, no forces are generated – unlike a guide zone. The same step asserted in the Office Action (i.e., step 72) as reading on posture maps and guide zones in fact articulates this very distinction. Step 72 in FIG. 4 is described as an act to "determine a geometry for the virtual surface, if a point penetrates at the proposed location." (emphasis added). Similarly, step 122 in the flowchart of FIG. 7A shows that if "[n]o points of virtual tool at the proposed location penetrate[s] the virtual surface," no force calculations are performed. The entirety of the Shih disclosure describes computing forces that result from contact between the two bodies on which collision detection is being performed (i.e., the virtual tool and the virtual surface). Shih is completely silent with respect to performing collision detection between two objects and

computing one or more feedback forces when the two bodies are not in contact. This concept of providing force to an object to compel it towards or away from a body when it is not in contact with another body is nowhere disclosed or suggested in Shih.

With respect to 2) above, Applicant respectfully disagrees with the Office Action's assertion that the "density evaluations and contact point determinations" are equivalent to niceness factors or snap fit regions. However, since each of the claims include limitations related to posture maps and/or guide zones, Applicant does not argue this in detail herein. Applicant notes, however, that "snap-fit regions" are a variant of guide zones and have nothing to do with niceness factors. Again, the Office Action has taken a teaching of Shih and applied it improperly to disparate concepts. Moreover, Applicant points out that the density values identified by the Office Action represent distances from the surface of the virtual object. The density values do not indicate the desirability of contact at a certain location between two objects, as is the case with niceness factors.

C. Claims 1, 10, 26, 35, 43, 47, 52 and 62

As mentioned above, each of the claims includes, or has been amended to include, limitations related to posture maps and/or guide zones, neither of which are disclosed or suggested in either Shih or Xavier. Limitation(s) distinguishing over Shih and Xavier are addressed with respect to each of the independent claims below.

i. Claim 1

Claim 1, as amended, includes limitations of computing a force vector based on a collision, when detected, and computing a force vector based on at least one guide zone when no collision is detected. The combination of Shih and Xavier is completely silent with this respect. In particular, nowhere does the combination disclose or suggest "computing the at least one force vector based on at least one guide zone when no collision is detected," as recited in claim 1. Therefore, claim 1 patentably distinguishes over the combination and is in allowable condition.

Claims 2 and 4-8 depend from claim 1 and are allowable for at least the same reasons.

ii. Claim 10

Claim 10, as amended for clarity, recites an act of "storing a plurality of postures of the tool to form a posture map, each of the plurality of postures indicating where the tool collides with

the body at a working surface of the tool, but does not otherwise collide with the tool, the plurality of postures stored in the posture map referenceable to determine, at least in part, a force-feedback vector." Nowhere does Shih or Xavier disclose or suggest anything related to storing postures to form a posture map, as recited in claim 10. Therefore, claim 10 patentably distinguishes over the combination and is in allowable condition.

Claims 11-25 depend from claim 10 and are allowable for at least the same reasons.

iii. Claim 26

Claim 26, as amended, relates to a system for controlling a simulation including a processing apparatus for providing a force vector based on a collision between a first and a second body and/or a force vector based on a posture map or a guide zone. As discussed above, the combination of Shih and Xavier is completely silent with respect to both posture maps and guide zones. In particular, nowhere does the combination of Shih and Xavier disclose or suggest a processing apparatus for "modifying the at least one force vector based on at least one of a plurality of postures stored in a posture map," as recited in claim 26. Therefore, claim 26 patentably distinguishes over the combination and is in allowable condition.

Claims 27 and 29-33 depend from claim 26 and are allowable for at least the same reasons.

iv. Claim 35

Claim 35, as amended, relates to determining a force vector in the presence of a collision based on the collision and computing a force vector in the absence of a collision based on a guide zone. Nowhere does the combination of Shih and Xavier disclose or suggest a method of providing haptic feedback "wherein in an event of the absence of penetration of the first and second representations, performing an act of computing at least one force vector based on a relationship between the first object and at least one guide zone," as recited in claim 35. Therefore, claim 35 patentably distinguishes over the combination and is in allowable condition.

Claims 36-42 depend from claim 35 and are allowable for at least the same reasons.

v. Claim 43

Claim 43, as amended, recites a method of generating a posture map in a virtual three-dimensional environment. As discussed above, neither Shih nor Xavier mentions subject matter related to posture map constructs. Specifically, the combination of Shih and Xavier does not

disclose nor suggest "selectively storing a plurality of postures of the at least one first object ... and determining whether to store any give posture of the at least one first object based on at least one of a niceness factor," as recited in claim 43. Therefore, claim 43 patentably distinguishes over the combination and is in allowable condition.

Claims 44-46 depend from claim 43 and are allowable for at least the same reasons.

vi. Claim 47

Claim 47, as amended, recites a posture map for generating guide paths for at least one first object. As discussed above, the posture map construct is no where disclosed or suggested in the combination of Shih and Xavier. As discussed above, the Office Action has based a rejection on the incorrect assertion that "determining a geometry for the virtual surface" is equivalent to "generation of a posture map." Moreover, the Office Action has failed to even allege how each of the limitations in claim 47 is shown by the combination of Shih and Xavier. Claim 47 recites a structure that is nowhere mentioned in either Shih or Xavier, and therefore patentably distinguishes over the combination and is in allowable condition.

Claims 48-51 depend from claim 47 and are allowable for at least the same reasons.

vii. Claim 52

Claim 52 recites a method of providing haptic feedback to a user including concepts related to posture maps and guide zones, including "providing haptic feedback to the user by providing a correction force to the haptic interface device computed based on at least one of a posture map of the first object in at least one guide zone," which patentably distinguishes over the combination of Shih and Xavier, placing claim 52 in allowable condition.

Claims 53-61 depend from claim 52 and are allowable for at least the same reasons.

vii. Claim 62

Claim 62 recites "an apparatus for controlling the simulated movement of a first object and a desired relation to at least one second object, the apparatus comprising...at least one of a posture map and a guide zone to urge the simulated movement of the first object in a desired relationship with the at least one second object." As discussed above, the combination of Shih and Xavier nowhere disclose or suggest the use of posture maps or guide zones, as recited in claim 62. Therefore, claim 62 patentably distinguishes over the combination and is in allowable condition.

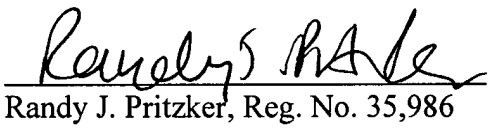
Claims 63-66 depend from claim 62 and are allowable for at least the same reasons.

CONCLUSION

A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

Respectfully submitted,
Stephen S. Ho et al., Applicants

By: 

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